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Mycological Notes.

BY BYRON D. HALSTED.

The Checking of Hollyhock Rust.—There was rejoicing in the Plant Hospital over one fungus that appeared there late in autumn for the first time. For two years it has been watched for and the plants treated to sprayings in anticipation of its advent.

The year 1889 may be set down as the time when the hollyhock rust (*Puccinia malvacearum* Mont.) made its appearance in a general manner in the United States. This is one year in advance of the outbreak of the carnation rust (*Uromyces caryophyllinus* Schr.) which came generally to the notice of the florists in 1890, and has remained as a serious menace ever since. In like manner 1896 is the year in which the asparagus rust (*Puccinia asparagi* DC.) came to us in a violent form and without any abatement during the past year. All three of these genuine rusts had been previously known in Europe for a long time, and came to us in a way that is not yet not fully understood.

But to return to the hollyhocks, it may be written that a row of plants were grown from seed and when three months old were set in the experiment area, and certain ones sprayed and others not, all through the growing season of 1896 without a single sorus of the rust appearing upon any plant either check or sprayed.

In passing it may be recorded that there was a large amount of the leaf spot (*Cercospora althaeina* Sacc.) and reward for the treatment was ample, for the fungicides worked admirably and kept the sprayed plants comparatively clean. During 1897 similar results were obtained for the fungicides with the *Cercospora*, but, best of all, the enemy for which the plants were set to catch appeared in October. It is worthy of remark that it came no earlier than this, the plants being closely watched. When first discovered the sori were quite young, but they increased rapidly in number, and soon became mature. The chief fact to be here recorded and to which all that has preceded is somewhat introductory is, that of the eighteen plants that were sprayed

only one showed the rust at all, while all of the untreated plants were more or less badly rusted. Here is an instance where spraying proved very effective against such a rapidly developing and deeply seated enemy as the hollyhock rust. The sprayings were made at intervals of about ten days varying somewhat and depending upon the weather.

Observation in Wind-infection of a Rust.—An instructive instance of one-sided infection was observed the past season in connection with the asparagus rust (*Puccinia asparagi* DC.). On September sixth, while inspecting asparagus fields in Gloucester County, New Jersey, the writer came to a field with quite an unusual green appearance, nearly all the fields being brown and lifeless so far as the brush was concerned, having been killed by the remarkable ravages of the rust fungus. The field in question had been cut over and the very rusty brush removed about five weeks before, with the hope that the new growth might escape the ravages of the *Puccinia*. At the date of the inspection the brush was about hip high and showing the rust only upon one side of each plant. So strikingly one-sided was the output of the rust sori that one could scarcely fail to observe it. Every main stem was almost completely covered with the rust upon one side, while the opposite bore almost no spots. It was also noticed that this rusted side varied somewhat at different ends of the long field, and at all points was at right angles to lines drawn from an old and very badly rusted bed of asparagus that stood with its end toward the broad side of the field in question and about forty rods away.

This observation teaches something concerning the rapidity of the development of the rust fungus. As the brush must needs have been developed to some extent before the uredospores could have alighted upon them, and also it is fair to judge that many of the sori upon the plants were fully ten days old, and, therefore not more than two weeks might have elapsed from the time when the spores came to the asparagus plants to that when sori were giving off their spores. The season was unusual, July being a very rainy month, and the long wet spell continued into August, followed by hot, moist weather particularly favorable for the development of fungi.

That the source of infection was the old asparagus bed is beyond question. About midway between the two beds stands a house and a few trees around it, and it was observed that there was less rust upon that portion of the new bed that was in line with this house and the old bed. In short, there was a barrier between the old bed and the new that interfered with the free passage of the spores. When the surface of the rusted stems of the old bed were dry and the winds blew from it towards the new bed, the spores were doubtless carried in great abundance, and these spores alighting upon the tender stems of the young shoots, encouraged by hot dewy nights, quickly germinated and rusted the plants. There is no reason to doubt that some of the rust spores were carried by the winds to long distances and infected plants miles from where they were produced.

A close Relation between Rainfall and Potato Rot.—The year 1897 had its counterpart in that of 1889. During the past ten years there have been in the Eastern States two Julys noted for their excess of rainfall as shown in the following averages of rainfall for New Jersey during the past ten years :

Year	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	Average
Rainfall	3.50	10.19	5.62	5.30	4.03	2.72	1.66	4.24	5.50	11.42	5.42

It is seen that in July, 1889, there was nearly double the average rainfall, and this amount was exceeded during the same month of last year.

In 1889 there was an unusual outbreak of potato rot, and both *Phytophthora infestans* D.By., and the bacterial disease working alone or together carried off a large portion of the potato crop. Large growers throughout whole sections of the country did not harvest their potatoes at all. Others dug them and after they were placed in heaps the rot worked their complete destruction.

Similar results have obtained in the potato fields the past year, and the writer recalls visiting some of the leading potato growing regions, only to review the scenes of 1889 and listen to the same story of heavy rains and destructive decay.

There have been seven Julys since 1889 that were either normal or comparatively dry, and during that time potato growers

have not complained of the rot. I do not remember of finding *Phytophthora* at all destructive during the period from 1889 to 1897; but the last season it was so abundant upon the experiment plots that the crop of potatoes was harvested unusually early to make sure of results in other directions. Nearly every leaf upon every plant showed first the frosty coating followed in a day or two with the wilting of the leaves.

It seems to me that the *Phytophthora* or late blight is quite dependent upon an abundance of moisture in midsummer, and if this relation is noted sufficiently the time may come, it may be predicted with reasonable certainty, that a wet July will mean a decaying potato crop, unless some successful method of checking this rapidly developing fungus is employed, and, contrariwise, a dry midsummer will insure freedom from its ravages.

The Phytophthora of Lima Beans.—In connection with what has been said above concerning the influence of copious rainfall upon the unusual development of the potato rot fungus it is in order to report that another member of the genus *Phytophthora* has been complained of bitterly during the season of 1897. The mildew of the lima beans, *Phytophthora phascoli* Thax., is a comparatively new one, having been described by Dr. Thaxter only eight years ago* and figured in the Annual Report of the Con-



* Botanical Gazette, 14: 273. N. 1889.

necticut Experiment Station for 1889, when it is stated that it was first noticed in September of that year, and in some cases a large portion of the crop was destroyed.

Particular emphasis is placed upon the date of the discovery and the fact that it was very abundant at the time it was taken, because that was the year in which the three months of July, August and September gave a total rainfall of 2.733 inches for New Jersey, and presumably as wet in Connecticut, which is 9.54 inches more than the average of those three months for the past ten years. Since 1889 the *Phytophthora* has been scarcely heard of until the present season when it has been as above stated so prevalent in some fields as to ruin the crop.

A fair sample of a diseased pod is shown in the engraving where the enlargement is double the normal size of all the parts. The mildew has a particular fondness for the pods and will attack them soon after flowering; in fact it was not difficult to find the whole inflorescence covered with the conidiophores before the first flower had come into bloom. The engraving shows also the general habit of the *Phytophthora* upon pods of two inches in length, in that it frequently makes its attack near the middle of the dorsal margin, and from there spreads over the pod towards the end and ventral suture and makes its densest growth of hyphae over the young seeds from which the needed nourishment is doubtless extracted abundantly.

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